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P. 2

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Summary

This project was to make balloon-borne investigations of the angular distribution of the Cosmic Microwave Background Radiation (CMBR) on angular scales from 0.5° to 180° in the millimeter and sub-millimeter spectral region. The experiments were carried out on two platforms; a survey gondola sensitive at angles larger than 3°, and in collaboration with Goddard Space Flight Center, a 1.5 m telescope gondola making measurements at angles of 0.5 to 1.5°. The survey experiment has yielded the most sensitive anisotropy measurements to date on any angular scale (Meyer et al. 1991).

The MIT Balloon-Borne MM wave Radiometer

The balloon-borne four-channel bolometric radiometer has spectral bands centered at 5.7, 9.2, 16.5, and 23. cm^{-1} (Page, Cheng, Meyer 1991b) each about 1 cm^{-1} wide. The radiometric sensitivity of these channels is $< 600\mu K_{Planck}\sqrt{sec}$ at 4.2 K in each of the first two channels. This figure takes into account the observation of a reference source. We have flown the radiometer for two successful flights in October 1989 and May 1990.

The Survey Anisotropy Experiment

Three flights by the survey instrument have produced a map of 45% of the sky in the four instrument spectral bands. The map at the lowest frequency, 5.6 cm^{-1} , was used to place the strongest constraints on CMBR anisotropy to date at any angular scale (Meyer, Cheng, and Page 1991). At the present the analysis is not limited by detector noise, rather, it is limited by foreground emission which can be removed using the higher frequency channels. At present we are using the correlation among the different spectral bands and with the InfraRed Astronomical Satellite (IRAS) map at 100 μm wavelength. We expect to be able to improve the experiment sensitivity a factor of two yielding a 95% confidence limit (CL) measurement of $\Delta T/T < 7. \times 10^{-6}$.

The spectrum of the mm band dust was measured (Page, Cheng and Meyer 1990) and found to be consistant with an dust emissivity which follows a power law with a form $\varepsilon \propto \nu^{1.5}$. This power law slope has now been comfirmed with the Cosmic Background Explorer (*COBE*) satellite. (Wright et al 1991).

The Small Scale Anisotropy Experiment

More recently, a new gondola has been built together with Goddard Space Flight Center in Greenbelt, MD. The new gondola is ready to fly in October 1991. Tests of the optics and the mechanical system are complete. This instrument will put new limits on the CMBR anisotropy at 0.5 degrees angular scale.

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